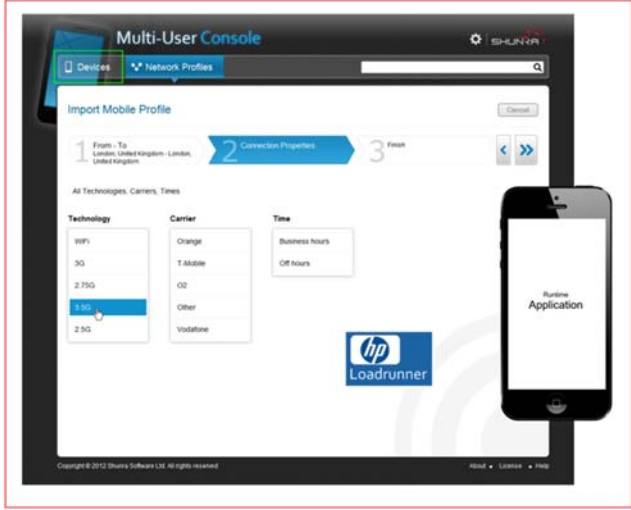# EXHIBIT 4

Claim 1, U.S. Pat. No. 9,971,678

Claim Element	Evidence of Infringement
A system for testing an application for a mobile device comprising:	The Accused System (including HP LoadRunner, HP Performance Center, Shunra Network Virtualization, HP Network Virtualization engine, HP Network Virtualization for Mobile, HP Network Capture, and/or any Micro Focus products related to any of the foregoing) is a system for testing an application for a mobile device.
	"HP LoadRunner and HP Performance Center with Shunra Network Virtualization
	Improve the performance of mobile apps through effective **testing**…Shunra Network Virtualization, which integrates seamlessly into HP LoadRunner or Performance Center, enhances **test accuracy** by incorporating real-world network conditions into the load and performance test environment, ensuring that the **test results are more reliable and accurate**...The combination of HP LoadRunner or Performance Center and Shunra Network Virtualization is the path to robust, reliable, and accurate **mobile performance testing**."
	HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 1-3, Ex. A.
	"Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by **enabling your mobile application development team** to fully and accurately assess the behavior and impact of the network on **mobile apps** before they are introduced to end users. By virtualizing real-world mobile network conditions within **testing environments**, your test results are more reliably predictive of how an **application** will behave for end users."
	HP Network Virtualization for Mobile, Page 2, Ex. B.
	The annotated image below illustrates the user interface for the LoadRunner platform, a system for testing an application for a mobile device.

Claim 1, U.S. Pat. No. 9,971,678

a software testing interface configured to simultaneously visually simulate, via one or more profile display windows, a plurality of operator network characteristics including at least bandwidth availability indicative of performance of the mobile device when executing the application;	The Accused System includes a software testing interface **[e.g., the LoadRunner interface]** configured to simultaneously visually simulate, via one or more profile display windows **[e.g., the window highlighted in green in the annotated image below]**, a plurality of operator network characteristics **[e.g., communication technology such as 2.5G, 3.5G, WiFi, etc.]** including at least bandwidth availability indicative of performance of the mobile device when executing the application **[e.g., the communication technology corresponds to bandwidth availability indicative of performance]**. Communication technology options are shown in the highlighted green box in the annotated image below.

Claim 1, U.S. Pat. No. 9,971,678

"HP Network Virtualization for Mobile allows tests to be managed and results analyzed from any laptop or Wi-Fi-connected mobile device. The software can import real-world mobile network profiles captured by HP Network Capture or provided by the HP Network Virtualization Library of mobile and broadband network conditions."

HP Network Virtualization for Mobile, Page 2, Ex. B.

"Because mobile network conditions are dynamic and vary by carrier, location, and time of day, it is essential for testing environments to accurately recreate multiple mobile network scenarios in order to analyze app performance and determine how network conditions affect different mobile users. The multi-flow capability in HP Network Virtualization for Mobile allows you to define a mobile test scenario that simultaneously emulates multiple user locations, each with its own unique set of virtualized mobile network conditions."

HP Network Virtualization for Mobile, Page 4, Ex. B.

As illustrated below, each of the communication technology options has a corresponding network profile, which include a plurality of network characteristics.

"Network Profiles . . . Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually. . . . The imported profiles are recordings of mobile

Claim 1, U.S. Pat. No. 9,971,678

conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world. . . . You can manually define specific network conditions for an individual test and then save the Profile to be used in other tests.

To import a Profile:

1   In the Network Profiles tab the following general profiles are displayed (these profiles are already imported and do not require Internet access):

3G: latency 75 ms, download 780 Kbps, upload 330 Kbps, packet loss 0%
Edge: latency 200 ms, download 100 Kbps, upload 100 Kbps, packet loss 0%
LTE: latency 40ms, download 10,000 Kbps, upload 7500 Kbps, packet loss 0%
DSL: latency 25ms, download 2000 Kbps, upload 256 Kbps, packet loss 0%
100% Loss: latency 0 ms, download 10000 Kbps, upload 10000 Kbps, packet loss 100%
Very Bad Network: latency 500 ms, download 1000 Kbps, upload 1000 Kbps, packet loss 10%"

HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Pages 19-20, Ex. C.

"HP Network Virtualization for Mobile is the only network virtualization solution designed specifically for the unique requirements of mobile app testing. Based on technology acquired from Shunra, this field-proven HP solution reduces the risk of poor mobile performance and helps your organization test, validate, and optimize the performance of your mobile apps before deployment."

HP Network Virtualization for Mobile, Page 1, Ex. B.

Claim 1, U.S. Pat. No. 9,971,678

	"Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by enabling your mobile application development team to fully and accurately assess the behavior and impact of the network on mobile apps before they are introduced to end users. By virtualizing real-world mobile network conditions within testing environments, your test results are more reliably predictive of how an application will behave for end users." **HP Network Virtualization for Mobile, Page 2, Ex. B.**
wherein the bandwidth availability is based at least in part on bandwidth data predetermined from interactions between one or more mobile devices and at least one operator network.	"Network Profiles . . . Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually. . . . The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world. . . . You can manually define specific network conditions for an individual test and then save the Profile to be used in other tests." **HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Page 19, Ex. C.** "Micro Focus Network Virtualization Network Performance Testing

Claim 1, U.S. Pat. No. 9,971,678

	Capture and emulate real-world network conditions, so you can execute network performance testing to detect and remediate issues before app deployment.

Discover and capture

Discover and capture live network performance conditions—such as latency, packet loss, bandwidth limitation and jitter—and recreate those conditions for network performance testing."

Micro   Focus   Corporate   Website,   available   at   https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview

"Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production."

Micro Focus Network Virtualization Data Sheet, Page 1, Ex. D.

"Use Network Capture to record and identify application performance problems occurring at a remote location, by measuring network conditions such as latency, packet loss, bandwidth availability across any given network topology. Network Capture can measure production links around the globe for a duration of up to one month."

HP Network Capture User Guide, Page 6, Ex. E.

"HP LoadRunner and HP Performance Center mobile testing protocols enable comprehensive performance testing of mobile applications for most mobile platforms—Android, iPhone®, Windows®, and others. Using the mobile protocols, the performance testing team is able to capture mobile traffic and generate realistic mobile load on the system under test.
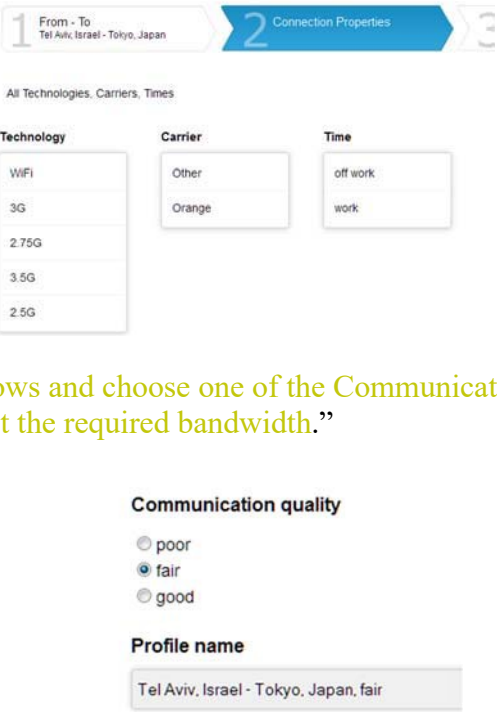
Features and benefits…

Shunra Network Virtualization enables an effective engineering methodology for application performance, providing the capabilities to discover real-world network conditions, virtualize those conditions in the test environment, analyze test results to isolate potential bottlenecks, and automatically deliver custom performance optimization recommendations. It provides: |

Claim 1, U.S. Pat. No. 9,971,678

| | NetworkCatcher: The ability to automatically gather real-world network conditions, collecting interval statistics that include bidirectional bandwidth, latency, jitter, and packet loss conditions

Global Library: Access to Shunra's Global Library of mobile and broadband conditions provides up-to-date average, best-case, and worst-case network conditions from thousands of cities worldwide."

HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 2-3, Ex. A. |

Claim 2, U.S. Pat. No. 9,971,678

Claim Element	Evidence of Infringement
The system of claim 1, wherein the software is configured to enable a user to select from one or more connection simulations for testing how well mobile content performs on the mobile device.	The software is further configured to enable a user to select from one or more network conditions for testing the mobile application. "In the Connection Properties, define the Technology, Carrier and Time of day. **Note:** The Technology and Carrier are related to the Client Location. Select the forward arrows and choose one of the Communication quality options. If a WiFi connection was selected, select the required bandwidth." **HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Page 20-21, Ex. C.** "Because mobile network conditions are dynamic and vary by carrier, location, and time of day, it is essential for testing environments to accurately recreate multiple mobile network scenarios in order to analyze app performance and determine how network conditions affect different mobile users. The multi-flow capability in HP Network Virtualization for Mobile allows you to define a mobile test

Claim 2, U.S. Pat. No. 9,971,678

	scenario that simultaneously emulates multiple user locations, each with its own unique set of virtualized mobile network conditions."
	HP Network Virtualization for Mobile, Page 4, Ex. B.
	"Micro Focus Network Virtualization Network Performance Testing
	Capture and emulate real-world network conditions, so you can execute network performance testing to detect and remediate issues before app deployment.
	Discover and capture
	Discover and capture live network performance conditions—such as latency, packet loss, bandwidth limitation and jitter—and recreate those conditions for network performance testing."
	Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview.
	"Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production."
	Micro Focus Network Virtualization Data Sheet, Page 1, Ex. D.
	"Network Profiles
	Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually.
	The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world."
	HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Page 19, Ex. C.

Claim 2, U.S. Pat. No. 9,971,678

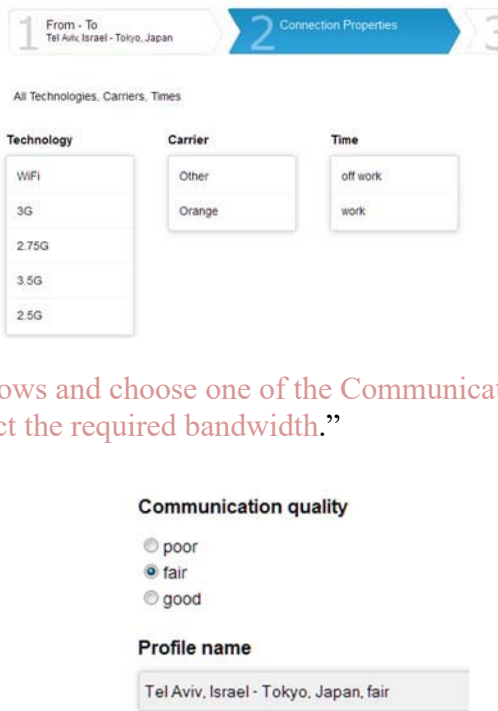|	
	"Use Network Capture to record and identify application performance problems occurring at a remote location, by measuring network conditions such as latency, packet loss, bandwidth availability across any given network topology. Network Capture can measure production links around the globe for a duration of up to one month."
	HP Network Capture User Guide, Page 6, Ex. E.
	"HP LoadRunner and HP Performance Center mobile testing protocols enable comprehensive performance testing of mobile applications for most mobile platforms—Android, iPhone®, Windows®, and others. Using the mobile protocols, the performance testing team is able to capture mobile traffic and generate realistic mobile load on the system under test.
	Features and benefits…
	Shunra Network Virtualization enables an effective engineering methodology for application performance, providing the capabilities to discover real-world network conditions, virtualize those conditions in the test environment, analyze test results to isolate potential bottlenecks, and automatically deliver custom performance optimization recommendations. It provides:
	NetworkCatcher: The ability to automatically gather real-world network conditions, collecting interval statistics that include bidirectional bandwidth, latency, jitter, and packet loss conditions
	Global Library: Access to Shunra's Global Library of mobile and broadband conditions provides up-to-date average, best-case, and worst-case network conditions from thousands of cities worldwide."
	HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 2-3, Ex. A.

Claim 3, U.S. Pat. No. 9,971,678

Claim Element	Evidence of Infringement
The system of claim 2, wherein the one or more connection simulations are configured to simulate wireless transmission of content to the mobile device based on the selected connection simulation.	The software is further configured to enable a user to select from one or more network conditions for testing the mobile application. "In the Connection Properties, define the Technology, Carrier and Time of day. **Note:** The Technology and Carrier are related to the Client Location. Select the forward arrows and choose one of the Communication quality options. If a WiFi connection was selected, select the required bandwidth." **HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Page 20-21, Ex. C.** "Because mobile network conditions are dynamic and vary by carrier, location, and time of day, it is essential for testing environments to accurately recreate multiple mobile network scenarios in order to analyze app performance and determine how network conditions affect different mobile users. The multi-flow capability in HP Network Virtualization for Mobile allows you to define a mobile test

Claim 3, U.S. Pat. No. 9,971,678

scenario that simultaneously emulates multiple user locations, each with its own unique set of virtualized mobile network conditions."

HP Network Virtualization for Mobile, Page 4, Ex. B.

"Micro Focus Network Virtualization Network Performance Testing

Capture and emulate real-world network conditions, so you can execute network performance testing to detect and remediate issues before app deployment.

Discover and capture

Discover and capture live network performance conditions—such as latency, packet loss, bandwidth limitation and jitter—and recreate those conditions for network performance testing."

Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview.

"Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production."

Micro Focus Network Virtualization Data Sheet, Page 1, Ex. D.

"Network Profiles

Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually.

The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world."

HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Page 19, Ex. C.

Claim 3, U.S. Pat. No. 9,971,678

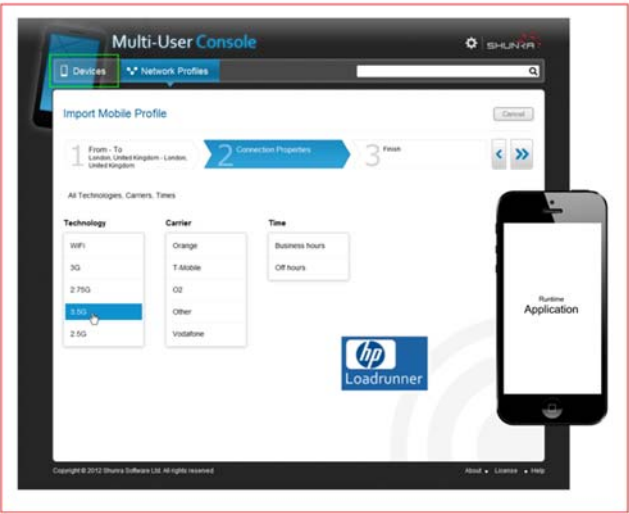|	
	"Use Network Capture to record and identify application performance problems occurring at a remote location, by measuring network conditions such as latency, packet loss, bandwidth availability across any given network topology. Network Capture can measure production links around the globe for a duration of up to one month." **HP Network Capture User Guide, Page 6, Ex. E.** "HP LoadRunner and HP Performance Center mobile testing protocols enable comprehensive performance testing of mobile applications for most mobile platforms—Android, iPhone®, Windows®, and others. Using the mobile protocols, the performance testing team is able to capture mobile traffic and generate realistic mobile load on the system under test. Features and benefits… Shunra Network Virtualization enables an effective engineering methodology for application performance, providing the capabilities to discover real-world network conditions, virtualize those conditions in the test environment, analyze test results to isolate potential bottlenecks, and automatically deliver custom performance optimization recommendations. It provides: NetworkCatcher: The ability to automatically gather real-world network conditions, collecting interval statistics that include bidirectional bandwidth, latency, jitter, and packet loss conditions Global Library: Access to Shunra's Global Library of mobile and broadband conditions provides up-to-date average, best-case, and worst-case network conditions from thousands of cities worldwide." **HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 2-3, Ex. A.**

Claim 26, U.S. Pat. No. 9,971,678

Claim Element	Evidence of Infringement
A system for testing an application for a mobile device comprising:	The Accused System (including HP LoadRunner, HP Performance Center, Shunra Network Virtualization, HP Network Virtualization engine, HP Network Virtualization for Mobile, HP Network Capture, and/or any Micro Focus products related to any of the foregoing) is a system for testing an application for a mobile device. "HP LoadRunner and HP Performance Center with Shunra Network Virtualization Improve the performance of mobile apps through effective **testing**…Shunra Network Virtualization, which integrates seamlessly into HP LoadRunner or Performance Center, enhances **test accuracy** by incorporating real-world network conditions into the load and performance test environment, ensuring that the **test results are more reliable and accurate**...The combination of HP LoadRunner or Performance Center and Shunra Network Virtualization is the path to robust, reliable, and accurate **mobile performance testing**." **HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 1-3, Ex. A.** "Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by **enabling your mobile application development team** to fully and accurately assess the behavior and impact of the network on **mobile apps** before they are introduced to end users. By virtualizing real-world mobile network conditions within **testing environments**, your test results are more reliably predictive of how an **application** will behave for end users." **HP Network Virtualization for Mobile, Page 2, Ex. B.** The annotated image below illustrates the user interface for the LoadRunner platform, a system for testing an application for a mobile device.

Claim 26, U.S. Pat. No. 9,971,678

a software testing interface configured to simultaneously visually simulate, via one or more profile display windows, a plurality of operator network characteristics including at least bandwidth availability indicative of performance of the mobile device when executing the application;	The Accused System includes a software testing interface **[e.g., the LoadRunner interface]** configured to simultaneously visually simulate, via one or more profile display windows **[e.g., the window highlighted in green in the annotated image below]**, a plurality of operator network characteristics **[e.g., communication technology such as 2.5G, 3.5G, WiFi, etc.]** including at least bandwidth availability indicative of performance of the mobile device when executing the application **[e.g., the communication technology corresponds to bandwidth availability indicative of performance]**. Communication technology options are shown in the highlighted green box in the annotated image below.

Claim 26, U.S. Pat. No. 9,971,678

"HP Network Virtualization for Mobile allows tests to be managed and results analyzed from any laptop or Wi-Fi-connected mobile device. The software can import real-world mobile network profiles captured by HP Network Capture or provided by the HP Network Virtualization Library of mobile and broadband network conditions."

HP Network Virtualization for Mobile, Page 2, Ex. B.

"Because mobile network conditions are dynamic and vary by carrier, location, and time of day, it is essential for testing environments to accurately recreate multiple mobile network scenarios in order to analyze app performance and determine how network conditions affect different mobile users. The multi-flow capability in HP Network Virtualization for Mobile allows you to define a mobile test scenario that simultaneously emulates multiple user locations, each with its own unique set of virtualized mobile network conditions."

HP Network Virtualization for Mobile, Page 4, Ex. B.

As illustrated below, each of the communication technology options has a corresponding network profile, which include a plurality of network characteristics.

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"Network Profiles . . . Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually. . . . The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world. . . . You can manually define specific network conditions for an individual test and then save the Profile to be used in other tests.

To import a Profile:

1   In the Network Profiles tab the following general profiles are displayed (these profiles are already imported and do not require Internet access):

3G: latency 75 ms, download 780 Kbps, upload 330 Kbps, packet loss 0%
Edge: latency 200 ms, download 100 Kbps, upload 100 Kbps, packet loss 0%
LTE: latency 40ms, download 10,000 Kbps, upload 7500 Kbps, packet loss 0%
DSL: latency 25ms, download 2000 Kbps, upload 256 Kbps, packet loss 0%
100% Loss: latency 0 ms, download 10000 Kbps, upload 10000 Kbps, packet loss 100%
Very Bad Network: latency 500 ms, download 1000 Kbps, upload 1000 Kbps, packet loss 10%"

HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Pages 19-20, Ex. C.

"HP Network Virtualization for Mobile is the only network virtualization solution designed specifically for the unique requirements of mobile app testing. Based on technology acquired from

Claim 26, U.S. Pat. No. 9,971,678

	Shunra, this field-proven HP solution reduces the risk of poor mobile performance and helps your organization test, validate, and optimize the performance of your mobile apps before deployment." **HP Network Virtualization for Mobile, Page 1, Ex. B.** "Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by enabling your mobile application development team to fully and accurately assess the behavior and impact of the network on mobile apps before they are introduced to end users. By virtualizing real-world mobile network conditions within testing environments, your test results are more reliably predictive of how an application will behave for end users." **HP Network Virtualization for Mobile, Page 2, Ex. B.**
wherein the bandwidth availability is based at least in part on bandwidth data predetermined from interactions between one or more mobile devices and at least one operator network	"Network Profiles . . . Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually. . . . The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world. . . . You can manually define specific network conditions for an individual test and then save the Profile to be used in other tests." **HP Network Mobile, Shunra Manual, Page 19,** **Virtualization for vCat for Mobile Ex. C.**

Claim 26, U.S. Pat. No. 9,971,678

	"Micro Focus Network Virtualization Network Performance Testing Capture and emulate real-world network conditions, so you can execute network performance testing to detect and remediate issues before app deployment. Discover and capture Discover and capture live network performance conditions—such as latency, packet loss, bandwidth limitation and jitter—and recreate those conditions for network performance testing." **Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview** "Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production." **Micro Focus Network Virtualization Data Sheet, Page 1, Ex. D.** "Use Network Capture to record and identify application performance problems occurring at a remote location, by measuring network conditions such as latency, packet loss, bandwidth availability across any given network topology. Network Capture can measure production links around the globe for a duration of up to one month." **HP Network Capture User Guide, Page 6, Ex. E.** "HP LoadRunner and HP Performance Center mobile testing protocols enable comprehensive

Claim 26, U.S. Pat. No. 9,971,678

	performance testing of mobile applications for most mobile platforms—Android, iPhone®, Windows®, and others. Using the mobile protocols, the performance testing team is able to capture mobile traffic and generate realistic mobile load on the system under test. Features and benefits… Shunra Network Virtualization enables an effective engineering methodology for application performance, providing the capabilities to discover real-world network conditions, virtualize those conditions in the test environment, analyze test results to isolate potential bottlenecks, and automatically deliver custom performance optimization recommendations. It provides: NetworkCatcher: The ability to automatically gather real-world network conditions, collecting interval statistics that include bidirectional bandwidth, latency, jitter, and packet loss conditions Global Library: Access to Shunra's Global Library of mobile and broadband conditions provides up-to-date average, best-case, and worst-case network conditions from thousands of cities worldwide." **HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 2-3, Ex. A**.
and the software is further configured to display data of either application performance, or network performance, or both.	The software is further configured to display application performance, or network performance, or both. **"Location-Aware Analytics** Network Virtualization software provides deep-dive analytic capabilities and location-specific network performance information. It helps you identify poorly performing business transactions and the root cause of performance issues. It provides service level and performance compliance reporting, and it is closely integrated with Micro Focus performance test products. **Key Features** While Network Virtualization software supports accurate prediction of the networked performance of

Claim 26, U.S. Pat. No. 9,971,678

applications before you deploy them, Network Virtualization Analytics lets you drill down into the root cause of performance issues, and it provides recommendations for optimizing Web and mobile apps."
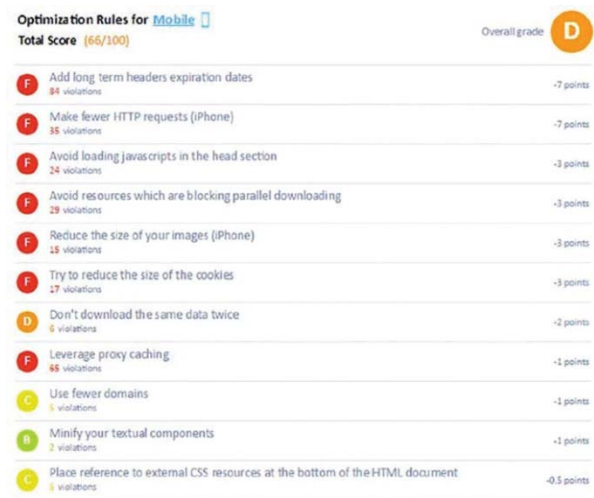

Figure 1. NV Analytics Report

"Web and Mobile Applications

In Network Virtualization Analytics, a waterfall diagram visualizes individual resource sizes and load times breaking down transaction response times, so you can quickly identify areas for optimization. These deep-dive capabilities show you how the end user experiences an application or page load and

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	provide insight into client-network server timing by sub transaction.

Whether you are analyzing Web-based, mobile Web-based, or native mobile applications, this information is critical to understanding the end user's perception of performance and where you should focus your optimization efforts.

Automated Optimization Recommendations

Micro Focus Application Performance Analytics provides a transaction scorecard."

Figure 2. NV Analytics Report Optimization Recommendations view

"In addition to providing extensive Web and mobile analysis, Network Virtualization Analytics delivers a transaction performance scorecard that automatically grades application performance and offers custom performance optimization suggestions based on industry accepted and additional proprietary rule sets. |

Claim 26, U.S. Pat. No. 9,971,678

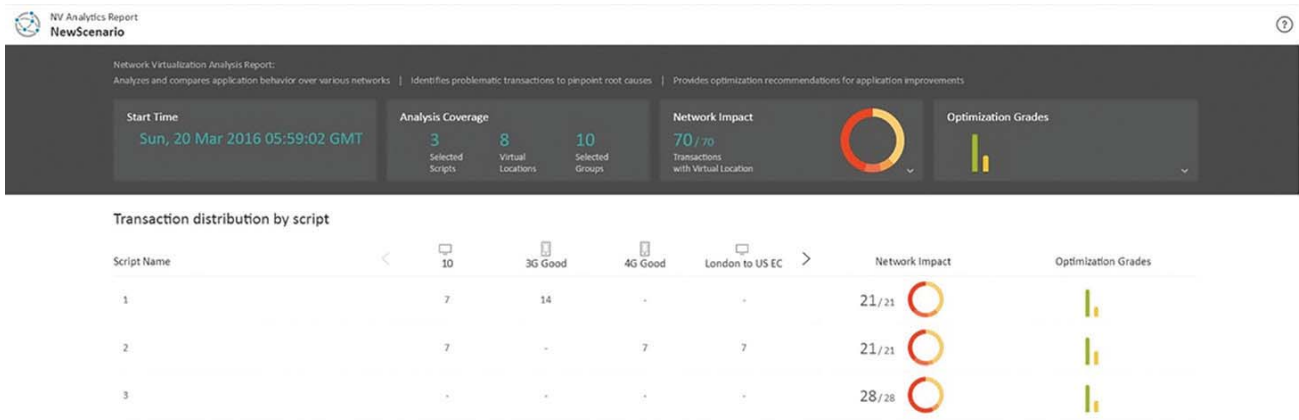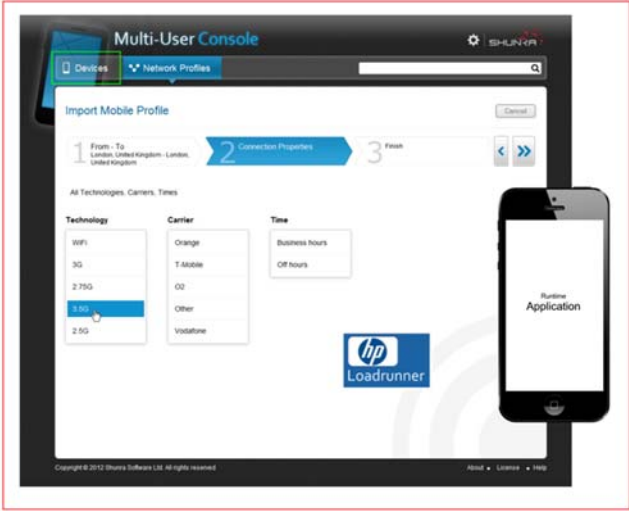|	
	These performance optimization suggestions help improve the load time of mobile-optimized sites by at least 20 percent and of standard websites by a typical level of 44 percent when viewed on an iPhone. With comprehensive analysis capabilities, you can quickly and reliably identify bottlenecks and get specific recommendations for performance optimization to help you deliver applications that live up to the expectations of your users." "Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production." **Figure 3. Analyst Report** **"Transaction Analysis** Obtaining enhanced performance information on each transaction enables quick isolation of the root cause of performance problems. Network Virtualization Analytics includes the following reports to enable rapid analysis and problem diagnosis: ■ The transaction analysis report shows how resource intensive a transaction is and enables

Claim 26, U.S. Pat. No. 9,971,678

	comparison with other applications that are consuming the same network resources.
	■ The bandwidth bottleneck report identifies throughput and bandwidth utilization for each transaction.
	■ The network and application error report highlights all application-related errors and isolates problems such as caching issues, unutilized buffer size, and other functional problems for remediation.
	■ The breakdown analysis of infrastructure shows the elapsed time an application spends on the server, the client, and the network, helping to pinpoint bottlenecks in the application infrastructure."
	Micro Focus Network Virtualization Data Sheet, Pages 1-4, Ex. D

Claim 37, U.S. Pat. No. 9,971,678

Claim Element	Evidence of Infringement
A system for testing an application for a mobile device comprising:	The Accused System (including HP LoadRunner, HP Performance Center, Shunra Network Virtualization, HP Network Virtualization engine, HP Network Virtualization for Mobile, HP Network Capture, and/or any Micro Focus products related to any of the foregoing) is a system for testing an application for a mobile device. "HP LoadRunner and HP Performance Center with Shunra Network Virtualization Improve the performance of mobile apps through effective testing…Shunra Network Virtualization, which integrates seamlessly into HP LoadRunner or Performance Center, enhances test accuracy by incorporating real-world network conditions into the load and performance test environment, ensuring that the test results are more reliable and accurate...The combination of HP LoadRunner or Performance Center and Shunra Network Virtualization is the path to robust, reliable, and accurate mobile performance testing." **HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 1-3, Ex. A.** "Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by enabling your mobile application development team to fully and accurately assess the behavior and impact of the network on mobile apps before they are introduced to end users. By virtualizing real-world mobile network conditions within testing environments, your test results are more reliably predictive of how an application will behave for end users." **HP Network Virtualization for Mobile, Page 2, Ex. B.** The annotated image below illustrates the user interface for the LoadRunner platform, a system for testing an application for a mobile device.

Claim 37, U.S. Pat. No. 9,971,678

a software testing interface configured to simultaneously visually simulate, via one or more profile display windows, a plurality of operator network characteristics including at least bandwidth availability indicative of performance of the mobile device when executing the application;	The Accused System includes a software testing interface **[e.g., the LoadRunner interface]** configured to simultaneously visually simulate, via one or more profile display windows **[e.g., the window highlighted in green in the annotated image below]**, a plurality of operator network characteristics **[e.g., communication technology such as 2.5G, 3.5G, WiFi, etc.]** including at least bandwidth availability indicative of performance of the mobile device when executing the application **[e.g., the communication technology corresponds to bandwidth availability indicative of performance]**. Communication technology options are shown in the highlighted green box in the annotated image below.

Claim 37, U.S. Pat. No. 9,971,678

 "HP Network Virtualization for Mobile allows tests to be managed and results analyzed from any laptop or Wi-Fi-connected mobile device. The software can import real-world mobile network profiles captured by HP Network Capture or provided by the HP Network Virtualization Library of mobile and broadband network conditions."

— — **HP Network Virtualization for Mobile, Page 2, Ex. B.**

"Because mobile network conditions are dynamic and vary by carrier, location, and time of day, it is essential for testing environments to accurately recreate multiple mobile network scenarios in order to analyze app performance and determine how network conditions affect different mobile users. The multi-flow capability in HP Network Virtualization for Mobile allows you to define a mobile test scenario that simultaneously emulates multiple user locations, each with its own unique set of virtualized mobile network conditions."

 — — **HP Network Virtualization for Mobile, Page 4, Ex B.**

As illustrated below, each of the technology options represents a network profile, which include a plurality of network characteristics.

"Network Profiles . . . Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually. . . . The imported profiles are recordings of mobile

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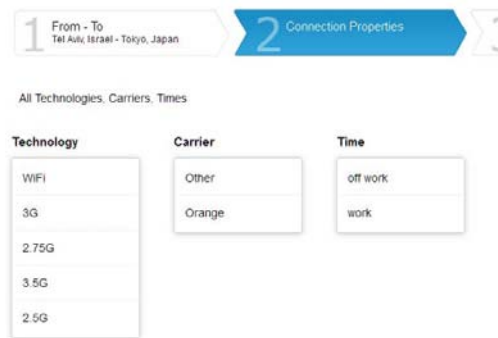|	
	conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world. . . . You can manually define specific network conditions for an individual test and then save the Profile to be used in other tests. To import a Profile: 1 In the Network Profiles tab the following general profiles are displayed (these profiles are already imported and do not require Internet access): 3G: latency 75 ms, download 780 Kbps, upload 330 Kbps, packet loss 0% Edge: latency 200 ms, download 100 Kbps, upload 100 Kbps, packet loss 0% LTE: latency 40ms, download 10,000 Kbps, upload 7500 Kbps, packet loss 0% DSL: latency 25ms, download 2000 Kbps, upload 256 Kbps, packet loss 0% 100% Loss: latency 0 ms, download 10000 Kbps, upload 10000 Kbps, packet loss 100% Very Bad Network: latency 500 ms, download 1000 Kbps, upload 1000 Kbps, packet loss 10%" **HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Pages 19-20, Ex. C.** "HP Network Virtualization for Mobile is the only network virtualization solution designed specifically for the unique requirements of mobile app testing. Based on technology acquired from Shunra, this field-proven HP solution reduces the risk of poor mobile performance and helps your organization test, validate, and optimize the performance of your mobile apps before deployment." **HP Network Virtualization for Mobile, Page 1, Ex. B.** "Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by enabling your mobile application development team to

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	fully and accurately assess the behavior and impact of the network on mobile apps before they are introduced to end users. By virtualizing real-world mobile network conditions within testing environments, your test results are more reliably predictive of how an application will behave for end users." **HP Network Virtualization for Mobile, Page 2, Ex B.**
wherein the bandwidth availability is based at least in part on bandwidth data predetermined from interactions between one or more mobile devices and at least one operator network	"Network Profiles . . . Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually. . . . The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world. . . . You can manually define specific network conditions for an individual test and then save the Profile to be used in other tests." **HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Page 19, Ex. C.** "Micro Focus Network Virtualization Network Performance Testing Capture and emulate real-world network conditions, so you can execute network performance testing to detect and remediate issues before app deployment.

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| | Discover and capture

Discover and capture live network performance conditions—such as latency, packet loss, bandwidth limitation and jitter—and recreate those conditions for network performance testing.”

Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview

“Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production.”

Micro Focus Network Virtualization Data Sheet, Page 1, Ex. D.

“Use Network Capture to record and identify application performance problems occurring at a remote location, by measuring network conditions such as latency, packet loss, bandwidth availability across any given network topology. Network Capture can measure production links around the globe for a duration of up to one month.”

HP Network Capture User Guide, Page 6, Ex. E.

“HP LoadRunner and HP Performance Center mobile testing protocols enable comprehensive performance testing of mobile applications for most mobile platforms—Android, iPhone®, Windows®, and others. Using the mobile protocols, the performance testing team is able to capture mobile traffic and generate realistic mobile load on the system under test.

Features and benefits…

Shunra Network Virtualization enables an effective engineering methodology for application performance, providing the capabilities to discover real-world network conditions, virtualize those conditions in the test environment, analyze test results to isolate potential bottlenecks, and automatically deliver custom performance optimization recommendations. It provides: |

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	NetworkCatcher: The ability to automatically gather real-world network conditions, collecting interval statistics that include bidirectional bandwidth, latency, jitter, and packet loss conditions Global Library: Access to Shunra's Global Library of mobile and broadband conditions provides up-to-date average, best-case, and worst-case network conditions from thousands of cities worldwide." **HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 2-3, Ex. A**.
and the software is further configured to interact with a network.	The software is enabled to interact with a network to enable cloud-based testing. **"StormRunner Load** **Cloud Load Testing** Simple, smart, and scalable cloud-based load and performance testing for web and mobile apps **Simple** Design and create mobile and web load test for easy cloud-based testing without the need to schedule, deploy, and manage load generators. **Smart** Detect problems fast and find your root cause with comprehensive analytics. **Scalable** Scale from 1 tester to 2,000,000 or more geographically distributed web and mobile users, add or remove them during runs." **Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview**

Claim 37, U.S. Pat. No. 9,971,678

The software interacting with a network, for example, and creating Virtual Users are highlighted in the red box in the annotated image below.
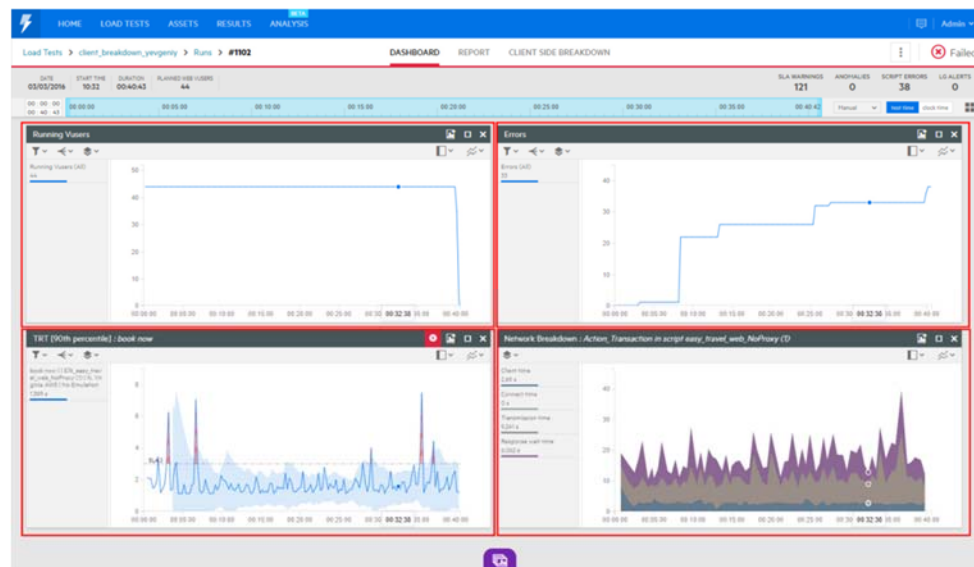

Figure 1. StormRunner Load
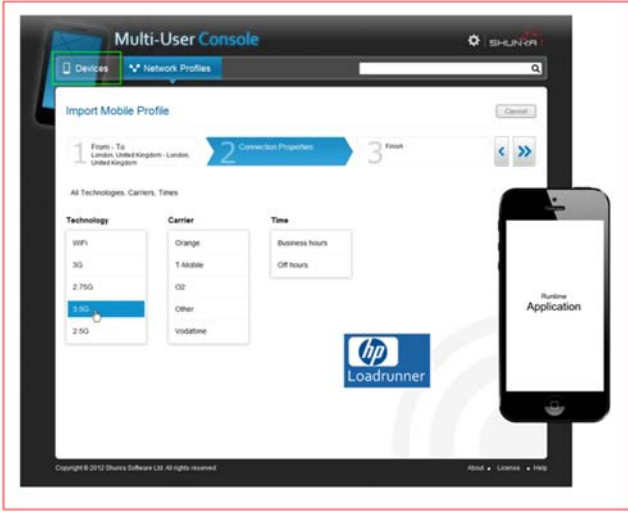
"Mobile performance optimization

Get an accurate picture of the end-to-end mobile performance. Combine virtual users and real devices, run simple, elastic, and realistic tests from multiple geographies across various real-world network conditions."

Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/mobile-testing/overview

Claim 45, U.S. Pat. No. 9,971,678

Claim Element	Evidence of Infringement
A system for testing an application for a mobile device comprising:	The Accused System (including HP LoadRunner, HP Performance Center, Shunra Network Virtualization, HP Network Virtualization engine, HP Network Virtualization for Mobile, HP Network Capture, and/or any Micro Focus products related to any of the foregoing) is a system for testing an application for a mobile device. "HP LoadRunner and HP Performance Center with Shunra Network Virtualization Improve the performance of mobile apps through effective **testing**…Shunra Network Virtualization, which integrates seamlessly into HP LoadRunner or Performance Center, enhances **test accuracy** by incorporating real-world network conditions into the load and performance test environment, ensuring that the **test results are more reliable and accurate**...The combination of HP LoadRunner or Performance Center and Shunra Network Virtualization is the path to robust, reliable, and accurate **mobile performance testing**." **HP LoadRunner and HP Performance Center with Shunra Network Virtualization, Page 1-3, Ex. A**. "Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by **enabling your mobile application development team** to fully and accurately assess the behavior and impact of the network on **mobile apps** before they are introduced to end users. By virtualizing real-world mobile network conditions within **testing environments**, your test results are more reliably predictive of how an **application** will behave for end users." **HP Network Virtualization for Mobile, Page 2, Ex. B.** The annotated image below illustrates the user interface for the LoadRunner platform, a system for testing an application for a mobile device.

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a software testing interface configured to simultaneously visually simulate, via one or more profile display windows, a plurality of operator network characteristics including at least bandwidth availability indicative of performance of the mobile device when executing the application;	The Accused System includes a software testing interface **[e.g., the LoadRunner interface]** configured to simultaneously visually simulate, via one or more profile display windows **[e.g., the window highlighted in green in the annotated image below]**, a plurality of operator network characteristics **[e.g., communication technology such as 2.5G, 3.5G, WiFi, etc.]** including at least bandwidth availability indicative of performance of the mobile device when executing the application **[e.g., the communication technology corresponds to bandwidth availability indicative of performance]**. Communication technology options are shown in the highlighted green box in the annotated image below.

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"HP Network Virtualization for Mobile allows tests to be managed and results analyzed from any laptop or Wi-Fi-connected mobile device. The software can import real-world mobile network profiles captured by HP Network Capture or provided by the HP Network Virtualization Library of mobile and broadband network conditions."

— — **HP Network Virtualization for Mobile, Page 2, Ex. B.**

"Because mobile network conditions are dynamic and vary by carrier, location, and time of day, it is essential for testing environments to accurately recreate multiple mobile network scenarios in order to analyze app performance and determine how network conditions affect different mobile users. The multi-flow capability in HP Network Virtualization for Mobile allows you to define a mobile test scenario that simultaneously emulates multiple user locations, each with its own unique set of virtualized mobile network conditions."

 — — **HP Network Virtualization for Mobile, Page 4, Ex B.**

As illustrated below, each of the technology options represents a network profile, which include a plurality of network characteristics.

"Network Profiles . . . Profiles define the conditions for the test. They can be based on Shunra's™

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Global Library recordings, or can be set manually. . . . The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world. . . . You can manually define specific network conditions for an individual test and then save the Profile to be used in other tests.

To import a Profile:

1   In the Network Profiles tab the following general profiles are displayed (these profiles are already imported and do not require Internet access):

3G: latency 75 ms, download 780 Kbps, upload 330 Kbps, packet loss 0%
Edge: latency 200 ms, download 100 Kbps, upload 100 Kbps, packet loss 0%
LTE: latency 40ms, download 10,000 Kbps, upload 7500 Kbps, packet loss 0%
DSL: latency 25ms, download 2000 Kbps, upload 256 Kbps, packet loss 0%
100% Loss: latency 0 ms, download 10000 Kbps, upload 10000 Kbps, packet loss 100%
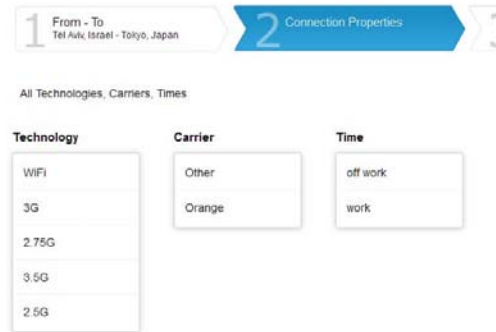Very Bad Network: latency 500 ms, download 1000 Kbps, upload 1000 Kbps, packet loss 10%"

HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Pages 19-20, Ex. C.

"HP Network Virtualization for Mobile is the only network virtualization solution designed specifically for the unique requirements of mobile app testing. Based on technology acquired from Shunra, this field-proven HP solution reduces the risk of poor mobile performance and helps your organization test, validate, and optimize the performance of your mobile apps before deployment."

HP Network Virtualization for Mobile, Page 1, Ex. B.

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	"Built on the HP Network Virtualization engine, HP Network Virtualization for Mobile bridges the gap between development and deployment by enabling your mobile application development team to fully and accurately assess the behavior and impact of the network on mobile apps before they are introduced to end users. By virtualizing real-world mobile network conditions within testing environments, your test results are more reliably predictive of how an application will behave for end users." **HP Network Virtualization for Mobile, Page 2, Ex B.**
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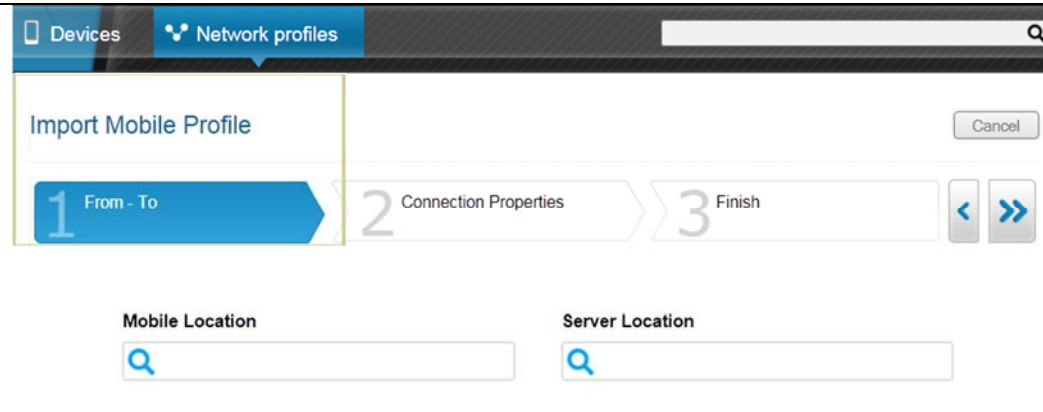|	
	Discover and capture Discover and capture live network performance conditions—such as latency, packet loss, bandwidth limitation and jitter—and recreate those conditions for network performance testing." **Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview** "Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production." **Micro Focus Network Virtualization Data Sheet, Page 1, Ex. D.** "Use Network Capture to record and identify application performance problems occurring at a remote location, by measuring network conditions such as latency, packet loss, bandwidth availability across any given network topology. Network Capture can measure production links around the globe for a duration of up to one month." **HP Network Capture User Guide, Page 6, Ex. E.** "HP LoadRunner and HP Performance Center mobile testing protocols enable comprehensive performance testing of mobile applications for most mobile platforms—Android, iPhone®, Windows®, and others. Using the mobile protocols, the performance testing team is able to capture mobile traffic and generate realistic mobile load on the system under test. Features and benefits… Shunra Network Virtualization enables an effective engineering methodology for application performance, providing the capabilities to discover real-world network conditions, virtualize those conditions in the test environment, analyze test results to isolate potential bottlenecks, and automatically deliver custom performance optimization recommendations. It provides:

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and interaction with a network enables the software to import real-world mobile network profiles.	The software is further configured to import real-world mobile network profiles. "Network Profiles Profiles define the conditions for the test. They can be based on Shunra's™ Global Library recordings, or can be set manually. The imported profiles are recordings of mobile conditions between two points. These recording files are stored in the Shunra Global Library which is a regularly updated, pre-populated set of more than 15 million recorded real-world data points of point-to-point network conditions recorded around the world." …In the From-To, select the Mobile and Server locations, such as the name of a city or state."

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HP Network Virtualization for Mobile, Shunra vCat for Mobile Manual, Page 19-20, Ex. C.

"APE — Best Practices

Discovery: identify and record real-world infrastructure and network conditions, business processes, application topology and deployment scenarios.

Pre-recorded library of global mobile and broadband network profiles enables rapid testing of mobile applications.

Pre-recorded network profiles for emulating typical mobile and broadband network conditions between major global cities."

Built-in MySQL database stores thousands of network profiles."

Shunra NetworkCatcher, Page 2, Ex. F.

"Micro Focus Network Virtualization
Network Performance Testing

Capture and emulate real-world network conditions, so you can execute network performance testing

Claim 45, U.S. Pat. No. 9,971,678

	to detect and remediate issues before app deployment. Discover and capture Discover and capture live network performance conditions—such as latency, packet loss, bandwidth limitation and jitter—and recreate those conditions for network performance testing." **Micro Focus Corporate Website, available at https://software.microfocus.com/en-us/products/network-virtualization-for-load-testing/overview** "Network Virtualization software allows you to discover and capture real-world network performance conditions from your production network, recreate network conditions in your lab during application testing, and optimize the applications to improve performance before you deploy into production." **Micro Focus Network Virtualization Data Sheet, Page 1, Ex D.** "Use Network Capture to record and identify application performance problems occurring at a remote location, by measuring network conditions such as latency, packet loss, bandwidth availability across any given network topology. Network Capture can measure production links around the globe for a duration of up to one month." **HP Network Capture User Guide, Page 6, Ex E.** "HP LoadRunner and HP Performance Center mobile testing protocols enable comprehensive performance testing of mobile applications for most mobile platforms—Android, iPhone®, Windows®, and others. Using the mobile protocols, the performance testing team is able to capture mobile traffic and generate realistic mobile load on the system under test.

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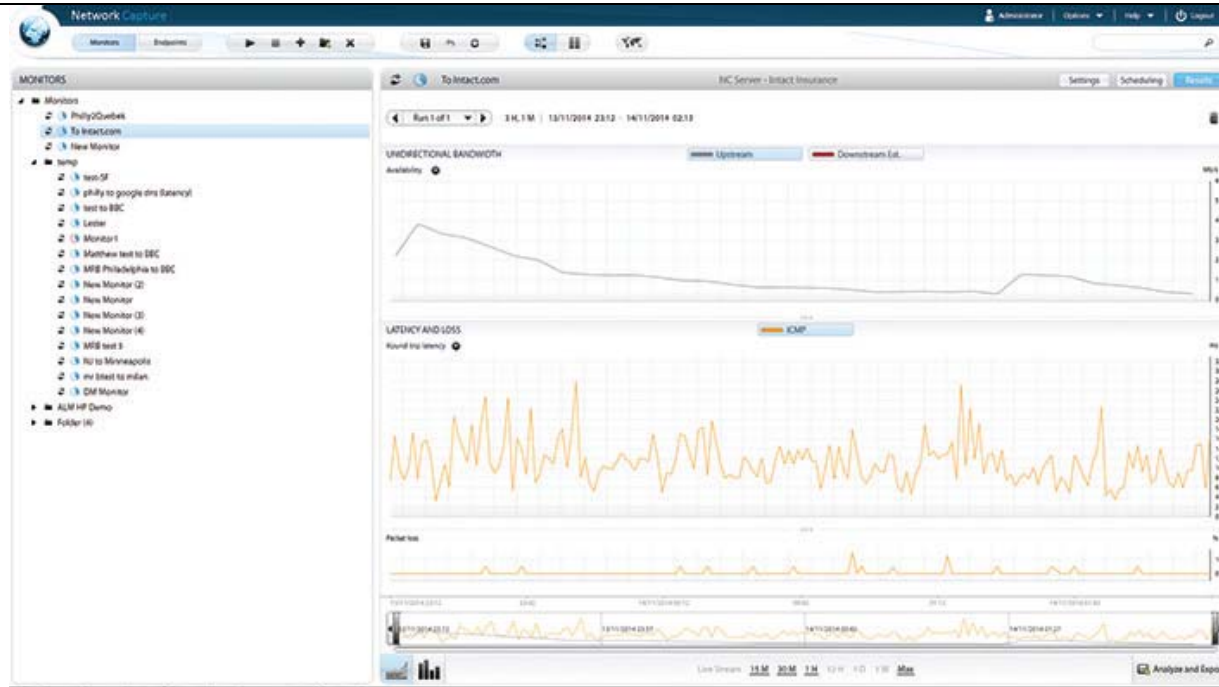**Claim 45, U.S. Pat. No. 9,971,678**

Figure 1. Network Capture

Micro Focus Network Virtualization Data Sheet, Page 2, Ex. D.